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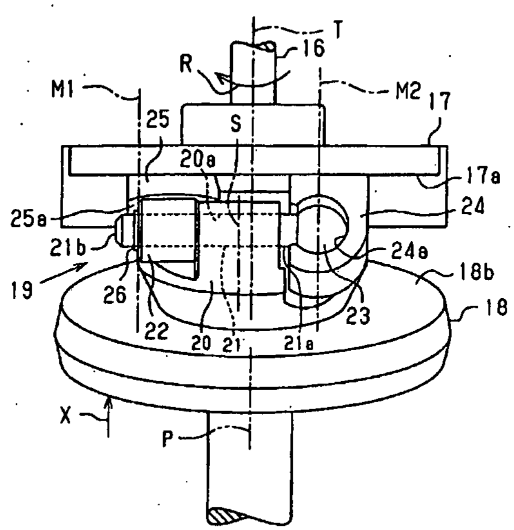
(54) **Variable displacement compressor**

(57) A variable displacement compressor (10) including a hinge mechanism (19) that is easily machined. The hinge mechanism is arranged in the compressor between the lug plate (17) and the cam plate (18). The hinge mechanism includes a support (20) formed on the cam plate. A spherical projection (23) extends from the support in a direction rearward with respect to the direction a drive shaft (16) rotates. A roller (22) extends from the support in a direction forward with respect to the direction the drive shaft rotates. A first cam (24) is formed on the lug plate surrounding and guiding the spherical portion. A second cam (25) is formed on the lug plate. The second cam includes a cam surface that contacts and guides the roller.

Fig.3



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Description

[0001] The present invention relates to a compressor, and more particularly, to a variable displacement compressor used in a refrigerant circuit of a vehicle air conditioner.

[0002] A variable displacement compressor used in a refrigerant circuit includes a housing that has cylinder bores and rotatably supports a drive shaft. The drive shaft supports a swash plate in an inclinable manner. A lug plate is fixed to the drive shaft to rotate integrally with the drive shaft. A hinge mechanism is arranged between the lug plate and the swash plate. A piston reciprocates in each cylinder bore. The piston is connected to a peripheral portion of the swash plate. When the drive shaft rotates, the rotation is transmitted to the swash plate through the lug plate and the hinge mechanism. This reciprocates the pistons and compresses refrigerant gas in the associated cylinder bores. Further, the hinge mechanism guides the swash plate and alters the inclination angle of the swash plate to change the stroke of the pistons. In this manner, the displacement of the variable displacement compressor is varied.

[0003] Japanese Laid-Open Patent Publication No. 2001-289159 describes an example of a hinge mechanism used in a variable displacement compressor. As shown in Fig. 1, a swash plate 101 has an end face 101a facing towards a lug plate 102 (thrust flange). A link pin 103 is arranged in the end face 101a. Spherical projections 103a and 103b project from opposite sides of the link pin 103. The lug plate 102 has an end face 102c facing towards the swash plate 101. A guide groove 102a for guiding the spherical projection 103a and a guide groove 102b for guiding the spherical projection 103b are provided near the end face 102c. When altering the inclination angle of the swash plate 101, the guide grooves 102a and 102b guide the movement of the spherical projections 103a and 103b of the link pin 103.

[0004] The lug plate 102 rotates in the direction of arrow R (rotation direction R) as shown in Fig. 1. More specifically, when the lug plate 102 is viewed from the side facing away from the end face 102c, the lug plate 102 rotates in the clockwise direction. The guide groove 102a, which is located forward to the link pin 103 in the rotation direction R, does not transmit torque from the lug plate 102 to the swash plate 101. Conversely, the other guide groove 102b transmits torque from the lug plate 102 to the swash plate 101. Accordingly, the guide groove 102b must be long enough and deep enough to accommodate and guide the spherical projection 103b. Further, the wall of the guide groove 102b must come into contact with the spherical projection 103b to transmit force to the spherical projection 103b in the rotation direction R. More specifically, the wall of the guide groove 102b must come into contact from the rearward side of the spherical projection 103b with respect to the rotation direction R.

[0005] The guide groove 102a, which does not transmit torque to the swash plate 101, does not have to be deep and long. Further, contact between the wall of the guide groove 102a and the spherical projection 103a is not required for the transmission of torque from the lug plate 102 to the swash plate 101, inclination of the swash plate 101, and for receiving the compression reaction applied to the swash plate 101 pistons.

[0006] Nevertheless, much burdensome machining is required to form deep and long grooves, that is, the guide grooves 102a and 102b. Accordingly, the machining of a hinge mechanism such as that shown in Fig. 1 requires much work.

[0007] The guide groove 102a, which does not transmit torque to the swash plate 101, has a wall located forward to the spherical projection 103a in the rotation direction R. Further, the distance between the spherical projection 103a and the spherical projection 103b is small. The distance between the guide groove 102a and the guide groove 102b is also small. Thus, the support of the lug plate 102 by the swash plate 101 is insufficient.

[0008] Compression reaction produced by the pistons may act on the swash plate 101 in an eccentric manner as shown by arrow X, which indicates the load center of the reaction. This may incline the swash plate 101 in a direction differing from the direction that the swash plate 101 inclines when varying the displacement. In such a case, the spherical projections 103a and 103b contact the walls of the guide grooves 102a and 102b in a manner differing from how they were designed to do so. This would increase sliding resistance between the walls of the guide grooves 102a and 102b and the associated spherical projections 103a and 103b, and may decrease the controllability of the displacement of the variable displacement compressor.

[0009] The present invention provides a variable displacement compressor having a hinge mechanism that is easily machined.

[0010] One embodiment of the present invention is a compressor that transmits rotation of a drive shaft from a lug plate to a cam plate, reciprocates a piston as the cam plate rotates to compress gas, and alters an inclination angle of the cam plate to vary displacement. The compressor includes a hinge mechanism arranged between the lug plate and the cam plate. The hinge mechanism includes a support formed on the cam plate. A first guide projection extends from the support in a direction rearward with respect to the direction the drive shaft rotates. A second guide projection extends from the support in a direction forward with respect to the direction the drive shaft rotates. A first cam, formed on the lug plate in a manner surrounding the first guide projection, guides the first guide projection. A second cam is formed on the lug plate and includes a cam surface for contacting and guiding the second guide projection.

[0011] A further embodiment of the present invention is a compressor including a housing, a cylinder bore formed in the housing, and a drive shaft supported in

the housing in a rotatable manner. A lug plate is connected to the drive shaft to rotate integrally with the drive shaft. A cam plate is supported by the drive shaft in an inclinable manner. The cam plate has a first surface facing towards the lug plate. The lug plate has a second surface facing towards the first surface of the cam plate. A piston has an end connected to the cam plate and reciprocated in the cylinder bore. A hinge mechanism is arranged between the lug plate and the cam plate. The hinge mechanism includes a support formed on the first surface. A first guide projection extends from the support in a direction rearward with respect to the direction the drive shaft rotates. A second guide projection extends from the support in a direction forward with respect to the direction the drive shaft rotates. A first cam, formed on the second surface in a manner surrounding the first guide projection, guides the first guide projection. A second cam is formed on the second surface and includes a cam surface for contacting and guiding the second guide projection.

[0012] Another embodiment of the present invention is a compressor including a housing, a cylinder bore formed in the housing, and a drive shaft supported in the housing in a rotatable manner. A lug plate is connected to the drive shaft to rotate integrally with the drive shaft. A cam plate is supported by the drive shaft in an inclinable manner. The cam plate has a first surface facing towards the lug plate. The lug plate has a second surface facing towards the first surface of the cam plate. A piston having an end connected to the cam plate is reciprocated in the cylinder bore. A hinge mechanism is arranged between the lug plate and the cam plate. The hinge mechanism has a support formed on the first surface and including an insertion hole. A pin is inserted through the insertion hole and has a spherical portion and a rotatable roller. The spherical portion extends from the support in a direction rearward with respect to the direction the drive shaft rotates. The roller extends from the support in a direction forward with respect to the direction the drive shaft rotates. A first cam is formed on the second surface and includes a groove surrounding and guiding the spherical portion. A second cam is formed on the second surface and includes a cam surface for contacting and guiding the roller.

[0013] Other embodiments and advantages of the present invention will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

[0014] The invention, and preferred objects and advantages thereof, may best be understood by reference to the following description of the certain exemplifying embodiments together with the accompanying drawings in which:

Fig. 1 is a cross-sectional view showing a hinge mechanism of a variable displacement compressor in the prior art;

Fig. 2 is a cross-sectional diagram of a variable displacement compressor according to a preferred embodiment of the present invention;

Fig. 3 is a plan view showing a hinge mechanism in the compressor of Fig. 2;

Fig. 4 is a side view showing the hinge mechanism of Fig. 3;

Fig. 5 is a plan view showing a hinge mechanism according to another embodiment of the present invention;

Fig. 6 is a plan view showing a hinge mechanism according to a further embodiment of the present invention; and

Fig. 7 is a plan view showing a hinge mechanism according to still another embodiment of the present invention.

[0015] In the drawings, like numerals are used for like elements throughout.

[0016] A variable displacement compressor 10 according to a preferred embodiment of the present invention will now be described with reference to Figs. 2 to 4. In the preferred embodiment, the compressor 10 is used in a refrigerant circuit of a vehicle air conditioner.

[0017] Fig. 2 is a cross-sectional view of the compressor 10. The left side as viewed in Fig. 2 will be referred to as the front side of the compressor 10, and the right side will be referred to as the rear side of the compressor 10. As shown in Fig. 2, the compressor 10 has a housing 10a, which includes a cylinder block 11, a front housing 12 fixed to the front end of the cylinder block 11, and a rear housing 14 fixed to the rear end of the cylinder block 11 by way of a valve plate 13.

[0018] A crank chamber 15 is defined in the housing 10a between the cylinder block 11 and the front housing 12. A drive shaft 16 extending through the crank chamber 15 is supported in a rotatable manner between the cylinder block 11 and the front housing 12. The drive shaft 16 is connected to an engine (not shown), which functions as a drive source for the vehicle. The drive shaft 16 is powered by the engine and rotated in the direction indicated by arrow R.

[0019] A generally disk-like lug plate 17 is fixed to the drive shaft 16 in the crank chamber 15 to rotate integrally with the drive shaft 16. The crank chamber 15 accommodates a swash plate 18, which functions as a cam plate. A shaft hole 18a, through which the drive shaft 16 is inserted, extends through a central portion of the swash plate 18. A hinge mechanism 19 is arranged between the lug plate 17 and the swash plate 18. The swash plate 18 is connected to the lug plate 17 by the hinge mechanism 19 and supported by the drive shaft 16 at the shaft hole 18a. The swash plate 18 rotates synchronously with the lug plate 17 and the drive shaft 16. Further, the swash plate 18 inclines relative to the drive shaft 16 as it slides along the drive shaft 16 in the axial direction.

[0020] A plurality of (only one shown in Fig. 2) equally

spaced cylinder bores 27 extend through the cylinder block 11 about the axis T of the drive shaft 16. A single-headed piston 28 reciprocates in each cylinder bore 27. The piston 28 closes the front opening of the cylinder bore 27. The front side of the valve plate 13 closes the rear opening of the cylinder bore 27. A compression chamber 29 is defined in the cylinder bore 27. The volume of the compression chamber 29 changes in accordance with the reciprocation of the piston 28.

[0021] The piston 28 is connected to the peripheral portion of the swash plate 18 by a pair of shoes 30. A suction chamber 31 and a discharge chamber 40 are defined between the valve plate 13 and the rear housing 14. The valve plate 13 includes a suction port 32 and a suction valve 33 located between each compression chamber 29 and the suction chamber 31. Further, the valve plate 13 includes a discharge port 34 and a discharge valve 35 located between each compression chamber 29 and the discharge chamber 40.

[0022] As each piston 28 moves from its top dead center position to its bottom dead center position, refrigerant gas (carbon dioxide in the preferred embodiment) is drawn into the corresponding compression chamber 29 from the suction chamber 31 through the associated suction port 32 and suction valve 33. As the piston 28 moves from the bottom dead center position to the top dead center position, the refrigerant gas in the compression chamber 29 is compressed to a predetermined pressure and discharged into the discharge chamber 40 through the associated discharge port 34 and discharge valve 35.

[0023] A bleed passage 36, a gas supply passage 37, and a control valve 38 are provided in the housing 10a of the compressor 10. The bleed passage 36 connects the crank chamber 15 and the suction chamber 31. The gas supply passage 37 connects the discharge chamber 40 and the crank chamber 15. The control valve 38, which is known in the art, is arranged in the gas supply passage 37.

[0024] The open amount of the control valve 38 is adjusted to control the balance between the amount of high-pressure discharge gas delivered into the crank chamber 15 through the gas supply passage 37 and the amount of gas delivered out of the crank chamber 15 through the bleed passage 36. This determines the internal pressure of the crank chamber 15. When the internal pressure of the crank chamber 15 changes, the difference between the internal pressure of the crank chamber 15 and the internal pressure of the compression chambers 29 also changes. This alters the inclination angle of the swash plate 18 (the angle of the swash plate 18 relative to a plane perpendicular to the axis T of the drive shaft 16). In this manner, the stroke of the pistons 28, or the displacement of the compressor 10, is adjusted.

[0025] For example, a decrease in the internal pressure of the crank chamber 15 increases the inclination of the swash plate 18. This lengthens the stroke of the pistons 28,and increases the displacement of the compressor 10. Conversely, an increase in the internal pressure of the crank chamber 15 decreases the inclination of the swash plate 18. This shortens the stroke of the pistons 28 and decreases the displacement of the compressor 10.

[0026] The hinge mechanism 19 will now be discussed.

[0027] As shown in Figs. 2 to 4, the swash plate 18 has an end face 18b facing towards the lug plate 17. A support 20 projects from the end face 18b toward the lug plate 17. The support 20 is located near a portion of the swash plate 18 that moves each piston 28 to the top dead center position. This portion of the swash plate 18 is referred to as a top dead center correspondence position P. A middle plane S is defined in the middle of the support 20 where the distal edge of the support 20 is equally divided into two. The middle plane S lies along a plane parallel to a plane including the axis T of the drive shaft 16 and the top dead center correspondence position P. The middle plane S is offset from the top dead center correspondence position P in the rotational direction R of the drive shaft 16.

[0028] An insertion hole 20a extends through the support 20 in a direction perpendicular to the middle plane S. A link pin 21 is press-fitted and fixed in the insertion hole 20a of the support 20. The link pin 21 includes a first end portion 21a (right end as viewed in Fig. 2) and a second end portion 21b (left end as viewed in Fig. 2), which extend from the support 20. The second end portion 21b is located forward to the first end portion 21a in the rotation direction R. In other wards, the first end portion 21a extends from the support 20 in a direction rearward with respect to the direction the drive shaft 16 rotates. Further, the second end portion 21b extends from the support 20 in a direction forward with respect to the direction the drive shaft 16 rotates.

[0029] The second end portion 21b of the link pin 21 supports a cylindrical roller 22 (second guide projection) in a rotatable manner. A snap ring 26 (stopper) is attached to the second end portion 21b to prevent the roller 22 from falling off the link pin 21. A spherical projection 23, which functions as a first guide projection, is formed integrally with the first end portion 21a.

[0030] The top dead center correspondence position P of the swash plate 18 is located between the roller 22 and the spherical projection 23. The distance between the roller 22 (specifically, plane M1 lying along the outer end face of the roller 22) and the top dead center correspondence position P is longer than the distance between the spherical projection 23 (specifically, plane M2 including the center of the spherical projection 23 and parallel to the middle plane S of the support 20) and the top dead center correspondence position P. The minimum distance between the spherical projection 23 and the support 20 is longer than the minimum distance between the roller 22 and the support 20.

[0031] The lug plate 17 has an end face 17a facing

towards the swash plate 18. A first cam 24 is formed on the end face 17a. The first cam 24 includes an inner surface 24a, which defines a relatively long and deep groove to guide the spherical projection 23. The inner surface 24a of the first cam 24 defines the wall of the groove that surrounds the spherical projection 23 from three directions, that is, from the rear with respect to the rotation direction R, from the direction of the swash plate 18, and from the direction of the lug plate 17. The inner surface 24a of the first cam 24 is sloped so that the disk portion of the lug plate 17 becomes farther as the drive shaft 16 becomes closer.

[0032] A second cam 25 is formed on the end face 17a of the lug plate 17. The second cam 25 is located forward to the first cam 24 with respect to the rotation direction R. Further, the second cam 25 has a cam surface 25a for guiding the roller 22. The cam surface 25a is sloped so that the disk portion of the lug plate 17 becomes farther as the drive shaft 16 becomes closer. In the second cam 25, only the cam surface 25a faces toward the roller 22. That is, the second cam 25 is open toward the front with respect to the rotation direction R. In other wards, the second cam 25 includes a front opposing the rotation direction R of the drive shaft 16 in which the front is open.

[0033] When torque is transmitted to the swash plate 18 from the lug plate 17, the inner surface 24a of the first cam 24 applies force to the spherical projection 23. The compression reaction produced by the compressed refrigerant gas is transmitted from the pistons 28 to the swash plate 18 in an eccentric manner as shown by arrow X, which indicates the load center of the reaction. The cam surface 25a of the second cam 25 mainly receives such compression reaction through the roller 22.

[0034] To increase the displacement of the compressor 10, the inclination angle of the swash plate 18 is altered. In such a state, the roller 22 moves away from the drive shaft 16 along the cam surface 25a of the second cam 25, and the spherical projection 23 moves away from the drive shaft 16 along the inner surface 24a in the first cam 24. To decrease the displacement of the compressor 10, the inclination angle of the swash plate 18 is altered. In such a state, the roller 22 moves toward the drive shaft 16 along the cam surface 25a of the second cam 25, and the spherical projection 23 moves toward the drive shaft 16 along the inner surface 24a in the first cam 24. In this manner, the first and second cams 24 and 25 guide the swash plate 18.

[0035] The compressor 10 of the preferred embodiment has the advantages described below.

(1) The second cam 25 of the hinge mechanism 19 is open to the front with respect to the rotation direction R. In other words, the second cam 25, which does not transmit torque from the lug plate 17 to the swash plate 18, is not a groove and does not have a wall that contacts the roller 22 in the rotational direction R. Accordingly, the burdensome machining of a deep groove is necessary only at one location, or at the first cam 24. Thus, the machining of the hinge mechanism 19 is simplified. This reduces the manufacturing cost of the compressor 10.

Furthermore, the cam surface 25a of the second cam 25 is not surrounded by any walls. Thus, the designing of the shape of the cam surface 25a is relatively simple. Accordingly, the profile (e.g., finely curved surface or combination of flat planes) of the cam surface 25a is easily designed so that the dead volume of the compression chambers 29 (i.e., clearance between each piston 28 and the valve plate 13 when the piston 28 is located at the top dead center position) remains constant even if the inclination angle of the swash plate 18 is altered.

In addition, the second end portion 21b of the link pin 21 may be projected out of the roller 22 because there are no walls around the cam surface 25a. This enables the attachment of the snap ring 26 to prevent the roller 22 from falling off the second end portion 21b. The snap ring 26 is attached to the second end portion 21b of the link pin 21 after mounting the roller 22 on the second end portion 21b. In this manner, the roller 22 is easily mounted on the link pin 21.

(2) In the second cam 25, only the cam surface 25a faces toward the roller 22. In other words, except for the cam surface 25a, the second cam 25 does not have any walls facing towards the roller 22. As a result, the distance between the roller 22 and the top dead center correspondence position P may be maximized. In other words, the distance between the roller 22 (plane M1) and the spherical projection 23 (plane M2) and thus the distance between the first cam 24 and the second cam 25 are long. Accordingly, the lug plate 17 stably supports the swash plate 18. Thus, even if the compression reaction X is transmitted from the pistons 28 to the swash plate 18 in an eccentric manner, the swash plate 18 is prevented from inclining in a direction differing from the direction it inclines to vary displacement. Further, slide resistance in the hinge mechanism is reduced, and the controllability of the displacement of the compressor 10 is improved.

(3) The link pin 21 supports the roller 22 in a rotatable manner. Accordingly, the roller 22 smoothly moves along the cam surface 25a of the second cam 25. This improves the controllability of the displacement of the compressor 10.

(4) The roller 22, which receives the compression reaction X, is located near the support 20. This reduces the stress produced by the compression reaction X and applied from the roller 22 to the link pin 21. Accordingly, the durability of the link pin 21

is improved. The load applied to the spherical projection 23 during the transmission of torque is small. Accordingly, the stress applied to the link pin 21 during the transmission of torque is small. Therefore, even if the spherical projection 23 is separated from the support 20, this does not affect the durability of the link pin 21.

(5) Carbon dioxide is used as the refrigerant for the vehicle air conditioner. It has been confirmed through experiments that the compression reaction X that acts on the swash plate 18 is greater when a carbon dioxide refrigerant is used than when a FREON refrigerant is used. It has also been confirmed through experiments that the compression reaction X acts on the peripheral portion of the swash plate 18.

[0036] In the preferred embodiment, the roller 22 is separated from the top dead center correspondence position P. Further, the distance between the roller 22 (plane M1) and the spherical projection 23 (plane M2) and thus the distance between the first cam 24 and the second cam 25 are long. Accordingly, in the compressor 10 that compresses carbon dioxide refrigerant gas, the hinge mechanism 19 and the lug plate 17 receive the compression reaction X acting on the swash plate 18 in a preferable manner. Further, the swash plate 18 is prevented from inclining in a direction differing from the direction it inclines to vary the displacement. The compressor 10 is thus suitable for compressing carbon dioxide refrigerant gas.

[0037] It should be apparent to those skilled in the art that the present invention may be embodied in many other specific forms. Particularly, it should be understood that the present invention may be embodied in the following forms.

[0038] As shown in Fig. 5, the roller 22 of the hinge mechanism 19 may be spherical. In this case, the cam surface 25a may be curved inwardly in correspondence with the spherical roller 22. The inwardly curved cam surface 25a is much shallower than the groove formed by the inner surface 24a of the first cam 24 (more specifically, the arc formed by the cross-section of the cam surface 25a is shorter than a semicircular arc). Accordingly, the hinge mechanism 19 is easily machined as advantage (1) of the preferred embodiment described above.

[0039] Referring to Fig. 6, the spherical projection 23 of the hinge mechanism 19 may be eliminated. In this case, the first end portion 21a of the link pin 21 functions as the first guide projection. The first cam 24 includes an elongated guide hole 24b into which the first end portion 21a of the link pin 21 is inserted. The first cam 24 directly contacts the support 20 support 20 to transmit torque from the lug plate 17 to the swash plate 18.

[0040] As apparent from Fig. 3, the diameter of the spherical projection 23 of the link pin 21 is greater than the diameter of the insertion hole 20a of the support 20. Instead, as shown in Fig. 7, the diameter of the spherical projection 23 may be smaller than the diameter of the insertion hole 20a. This enables the link pin 21, which includes the spherical projection 23, to be cut out from single rod material. Since the spherical projection 23 and the link pin 21 are formed integrally, the number of parts forming the hinge mechanism 19 is reduced.

[0041] The spherical projection 23 having a diameter smaller than the insertion hole 20a may be inserted through the insertion hole 20a. More specifically, when connecting the link pin 21 and the swash plate 18, the link pin 21 may be inserted through the insertion hole 20a of the support 20 from the first end portion 21a. In the embodiment of Fig. 7, a flange 21c is formed integrally with the link pin 21 at the edge of the second end portion 21b to prevent the roller 22 from falling off. Accordingly, the snap ring 26 (refer to Fig. 3), which is separate from the link pin 21, is not necessary. This reduces the number of parts forming the hinge mechanism 19.

[0042] The cam surface 25a of the second cam 25 may be outwardly curved toward the roller 22.

[0043] The roller 22 may be extended toward the support 20, and the support 20 may be narrowed by the extended amount of the roller 22.

[0044] The spherical projection 23 of the link pin 21 may be supported in a rotatable manner. When the inclination angle of the swash plate 18 is altered, the spherical projection 23 moves along the inner surface 24a of the first cam 24. That is, the first guide projection may be a roller.

[0045] In the embodiments of Figs. 2 to 7, the roller 22 is employed as the second guide projection of the hinge mechanism 19. Instead, the second guide projection may be fixed to the support so that it does not rotate.

[0046] The support 20 of the hinge mechanism 19 (specifically, the middle plate S) may be formed in alignment with the top dead center correspondence position P.

[0047] The distance between the roller 22 and the support 20, and the distance between the spherical projection 23 and the support 20 may be the same.

[0048] In the embodiments of Figs. 2 to 7, the present invention is applied to a swash plate type variable displacement compressor 10. Instead, the present invention may be applied to a wobble type variable displacement compressor.

[0049] In the preferred embodiment, carbon dioxide is used as the refrigerant of the vehicle air conditioner. However, a FREON refrigerant may be used instead. In other words, the present invention may be applied to a variable displacement compressor where FREON is the refrigerant gas.

[0050] The present examples and embodiments are to be considered as illustrative and not restrictive.

Claims

1. A compressor (10) that transmits rotation of a drive shaft (16) from a lug plate (17) to a cam plate (18), reciprocates a piston (28) as the cam plate rotates to compress gas, and alters an inclination angle of the cam plate to vary displacement, the compressor comprising a hinge mechanism (19) arranged between the lug plate and the cam plate, the compressor **characterized in that**
   the hinge mechanism includes a support (20) formed on the cam plate, a first guide projection (23) extending from the support in a direction rearward with respect to the direction the drive shaft rotates, a second guide projection (22) extending from the support in a direction forward with respect to the direction the drive shaft rotates, a first cam (24), formed on the lug plate in a manner surrounding the first guide projection, for guiding the first guide projection, and a second cam (25) formed on the lug plate and including a cam surface for contacting and guiding the second guide projection.

2. The compressor according to claim 1, **characterized in that** the second cam includes a front opposing the rotational direction of the drive shaft in which the front is open.

3. The compressor according to claim 1 or 2, wherein the piston is moved to a top dead center position, and the cam plate includes a portion (P) located between the first guide projection and the second guide projection for moving the piston to the top dead center position of the piston, the compressor **characterized in that**
   the distance between the second projection and the portion is greater than the distance between the first guide projection and the portion.

4. The compressor according to any one of claims 1 to 3, **characterized in that** the hinge mechanism further includes a pin portion (21b) extending from the support along the axis intersecting the drive shaft, in which the second guide projection includes a roller supported by the pin portion in a rotatable manner.

5. The compressor according to claim 4, **characterized in that** the support includes an insertion hole (20a), and the hinge mechanism includes a pin (21) inserted through the insertion hole of the support, the pin having a first end portion (21a) with a spherical portion defining the first guide and a second end portion defining the pin portion, wherein the spherical portion has a diameter that is smaller than that of the insertion hole.

6. The compressor according to claim 5, **characterized in that** the spherical portion is formed integrally with the pin.

7. The compressor according to claim 5 or 6, **characterized in that** the pin includes a stopper, integrally formed with the second end portion, for preventing the roller from falling off the pin.

8. The compressor according to any one of claims 4 to 7, **characterized in that** the pin portion extends out of the roller.

9. The compressor according to any one of claims 1 to 8, **characterized in that** the distance between the second guide projection and the support is less than the distance between the first guide projection and the support.

10. The compressor according to any one of claims 1 to 9, **characterized in that** the compressor compresses carbon dioxide refrigerant gas for an air conditioner.

11. The compressor according to any one of claims 1 to 10, **characterized in that** the first cam includes a groove for guiding the first guide projection.

12. The compressor according to any one of claims 1 to 10, **characterized in that** the first cam includes an elongated hole for guiding the first guide projection.

13. The compressor according to any one of claims 1 to 12, **characterized in that** the first guide projection extends from the support rearward from the second guide projection with respect to the rotational direction of the drive shaft.

14. A compressor (10) comprising:

    a housing (10a), a cylinder bore (27) formed in the housing, a drive shaft (16) supported in the housing in a rotatable manner, a lug plate (17) connected to the drive shaft to rotate integrally with the drive shaft, a cam plate (18) supported by the drive shaft in an inclinable manner, the cam plate having a first surface (18b) facing towards the lug plate, and the lug plate having a second surface (17a) facing towards the first surface of the cam plate, a piston (28) having an end connected to the cam plate and reciprocated in the cylinder bore, and a hinge mechanism (19) arranged between the lug plate and the cam plate, the compressor **characterized in that**
    the hinge mechanism includes a support (20) formed on the first surface, a first guide projection (23) extending from the support in a direc-

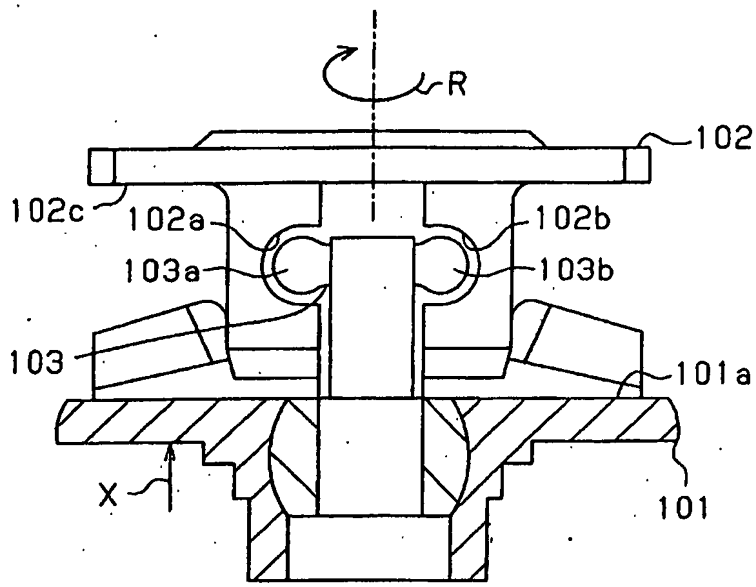
tion rearward with respect to the direction the drive shaft rotates, a second guide projection (22) extending from the support in a direction forward with respect to the direction the drive shaft rotates, a first cam (24), formed on the second surface in a manner surrounding the first guide projection, for guiding the first guide projection, and a second cam (25) formed on the second surface and including a cam surface for contacting and guiding the second guide projection.

15. A compressor (10) comprising:

a housing (10a), a cylinder bore (27) formed in the housing, a drive shaft (16) supported in the housing in a rotatable manner, a lug plate (17) connected to the drive shaft to rotate integrally with the drive shaft, a cam plate (18) supported by the drive shaft in an inclinable manner, the cam plate having a first surface (18b) facing towards the lug plate, and the lug plate having a second surface (17a) facing towards the first surface of the cam plate, a piston (28) having an end connected to the cam plate and reciprocated in the cylinder bore, and a hinge mechanism (19) arranged between the lug plate and the cam plate, the compressor **characterized in that**
the hinge mechanism includes a support (20) formed on the first surface and including an insertion hole (20a), a pin (21) inserted through the insertion hole and having a spherical portion (23) and a rotatable roller (22), the spherical portion extending from the support in a direction rearward with respect to the direction the drive shaft rotates, and the roller extending from the support in a direction forward with respect to the direction the drive shaft rotates, a first cam (24) formed on the second surface and including a groove surrounding and guiding the spherical portion, and a second cam (25) formed on the second surface and including a cam surface for contacting and guiding the roller.

16. The compressor according to claim 15, **characterized in that** the groove and the cam surface are sloped so that the second surface becomes farther as the drive shaft becomes closer.

Fig.1



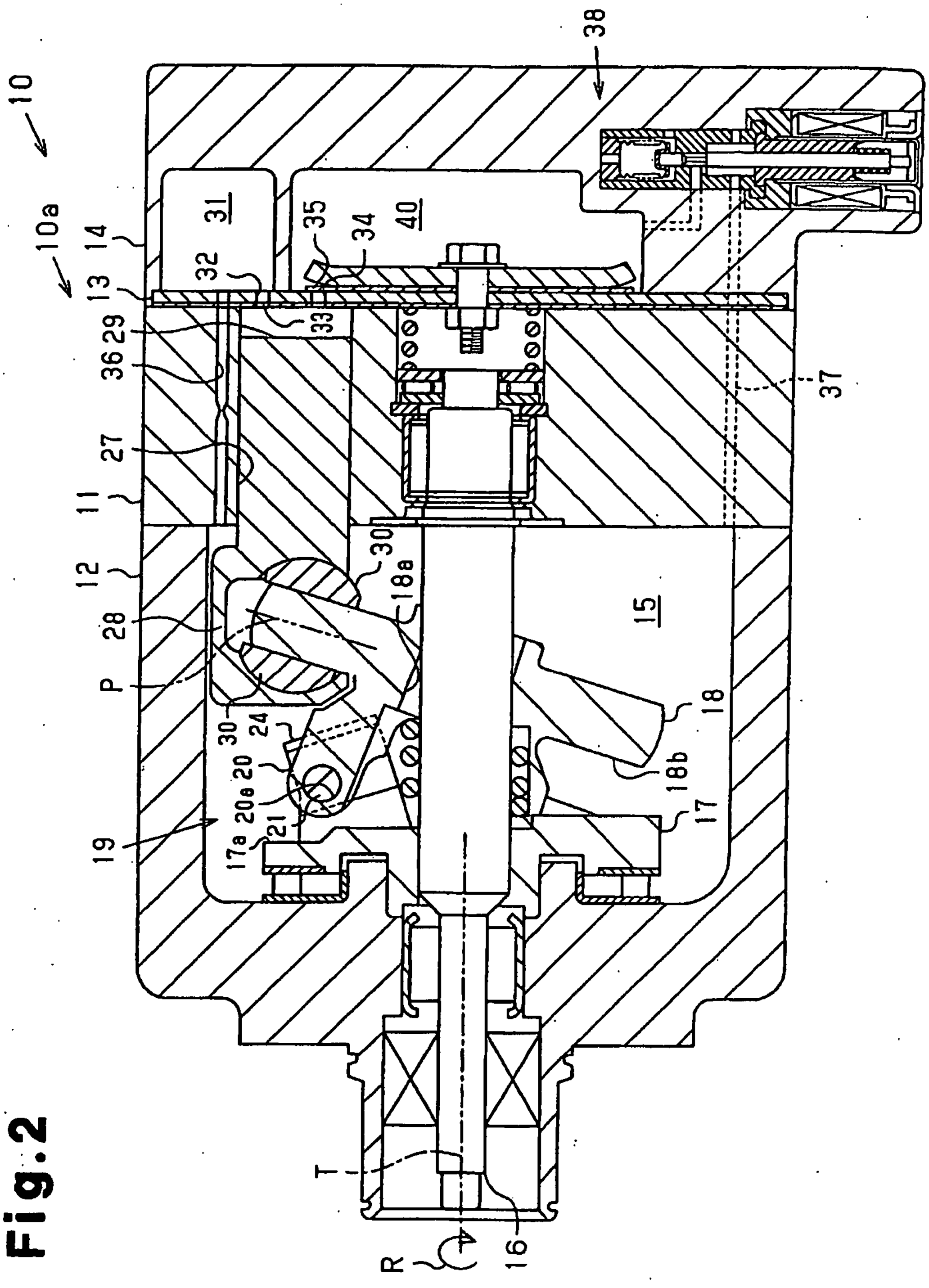

10
10a
14
13
29
36
27
11
12
28
P
30
24
20
20a
21
17a
19
31
32
33
35
34
40
38
37
30
18a
15
18
18b
17
T
16
R

Fig.2

Fig.3

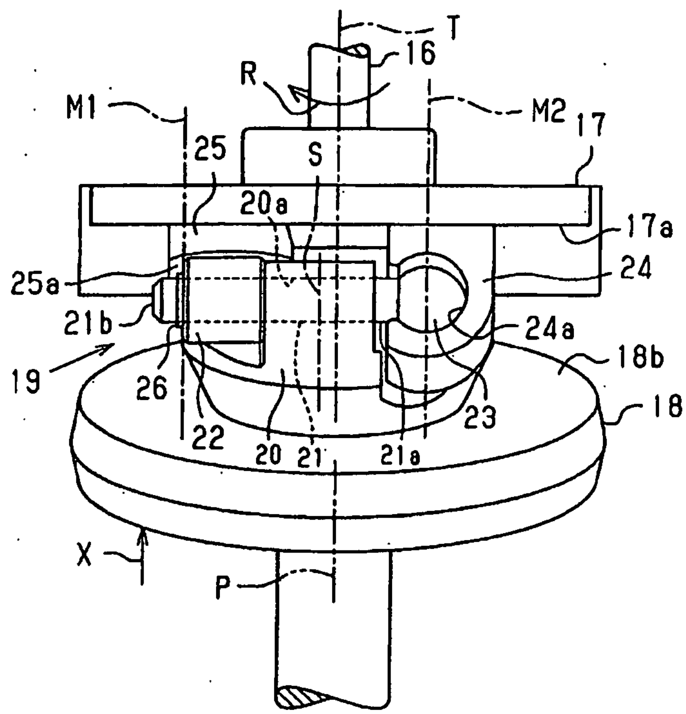

T
16
R
M1
M2
17
25
S
20a
17a
25a
24
21b
24a
19
18b
26
18
22
23
20
21
21a
X
P

Fig.4

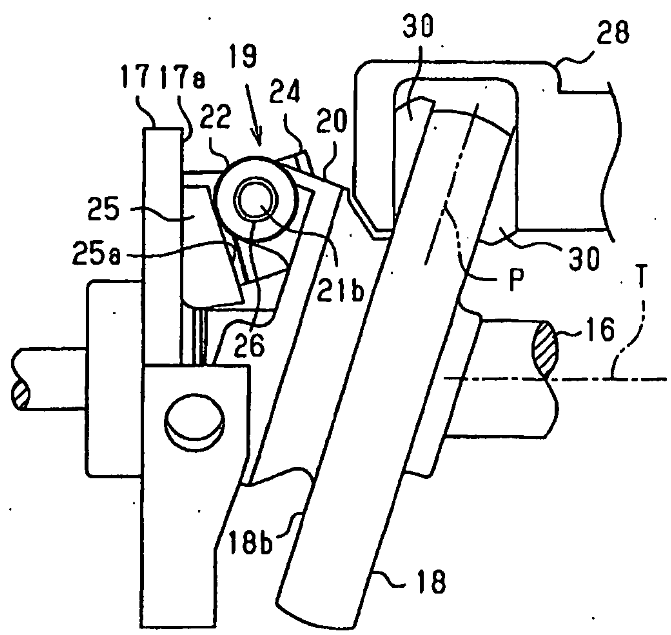

30
28
19
17
17a
24
22
20
25
25a
30
21b
P
T
26
16
18b
18

Fig.5

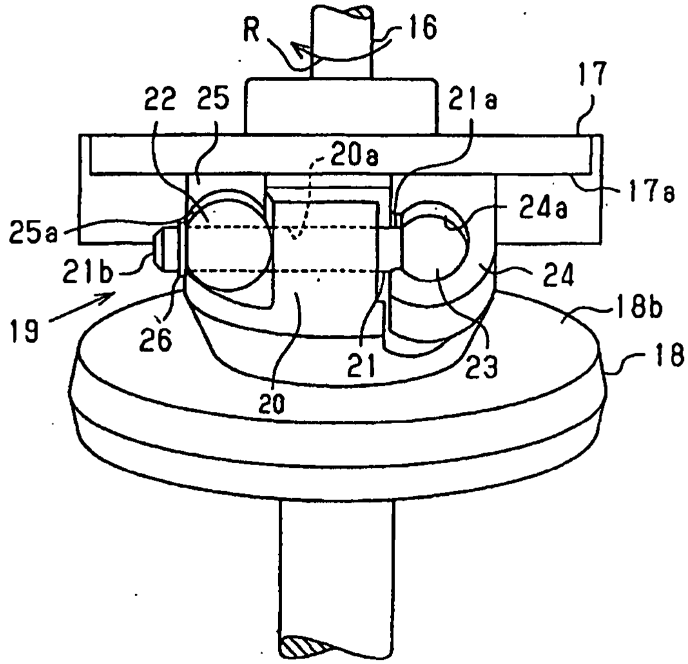

R
16
17
22
25
21a
20a
17a
25a
24a
21b
24
19
26
21
23
18b
18
20

Fig.6

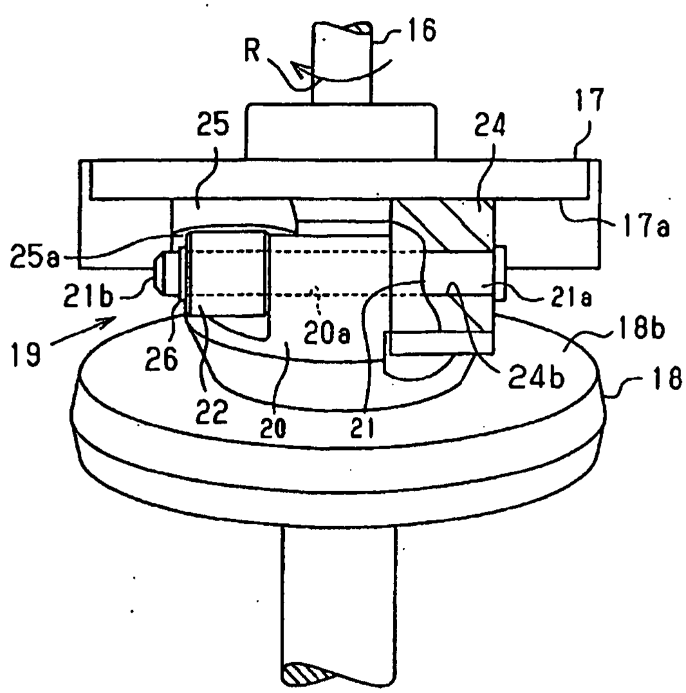

R
16
17
25
24
17a
25a
21b
21a
20a
18b
19
26
24b
18
22
20
21

Fig.7